Quantitative versus qualitative in neuromarketing research

Monica Diana Bercea

"Alexandru Ioan Cuza" University, Faculty of Economics and Business Administration, Department of Marketing, Iaşi, Romania

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Bercea, Monica Diana
"Alexandru Ioan Cuza" University, Faculty of Economics and Business Administration, Department of Marketing, Iaşi, Romania

Abstract

Marketing research methods continuously develop and over the last decade technology offered solutions to improve this area. Traditional marketing research methods fail at some point in certain cases, and since emotions are mediators of how consumers process marketing messages, understanding of cognitive responses to advertisements have always been a challenge in methodology. Neuromarketing is the branch of neuroscience research that aims to better understand the consumer through his unconscious processes and has application in marketing, explaining consumer's preferences, motivations and expectations, predicting his behavior and evaluating successes or failures of advertising messages. In this context, this study aims to analyze relatively new alternative techniques in neuromarketing research, from quantitative and qualitative perspectives. After presenting the common space between quantitative research and neuromarketing research, respectively between qualitative research and neuromarketing research, the study will conclude on whether neuromarketing research is closer to a quantitative approach, or to a qualitative one.

Key words: neuromarketing, quantitative research, qualitative research, marketing research

1. Introduction

Neuroscience gathers information on the structure and functions of the brain and its sub-domain called cognitive neuroscience seeks to understand the neural mechanisms behind thoughts, reasoning, emotions, memory or decision making. Using technology advances in neuroscience, researchers can obtain information on brain responses to marketing stimuli, not having full confidence in what they report. They provide new ways for understanding how consumers store, retrieve, develop and use information. Neuromarketing is an emerging interdisciplinary field that aims to investigate and understand consumer behavior by studying the brain. Thus, using neuroimaging techniques, researchers measure subjects' responses to marketing stimuli. Therefore, the development of this field depends on the advance of science, technology, neuroscience and computer science.

As Garcia et al. (2008) remarks, given its status as a young discipline, the theoretical, empirical and practical scope of neuromarketing is still being developed. Also, Zurawicki (2010) considers that there is an important opportunity for this field, as by better understanding the neural world of consumers we can help them and the brands that serve them better adapt to an increasingly complex and overwhelming world.

2. Brief presentation of neuromarketing methodology

In order to be able to discuss qualitative and quantitative aspects from neuromarketing research, in the following part there will be briefly presented each technique that can be used and its experimental procedure, as founded in the literature.

Functional Magnetic Resonance Imaging (fMRI) represents an appropriate methodology for uncovering the areas of the brain activation in response to a very simple experimental design with little potential for the temporal dimension to be a problem, as Lee et al. remarks (2009). fMRI combines magnetic field and radio waves, producing a signal that allows viewing brain structures in detail and following the metabolic activity in the brain (Perrachione et al. 2008). As Zurawiki (2010) explains, the subject lies on a bed, with the head surrounded by a large magnet which causes the atom particles (protons) inside the subject's head to align with the magnetic field. As blood contains iron, the iron atoms that are not bound to oxygen produce small distortions in the nearer magnetic field and when a certain brain area is active, corresponding blood vessels dilate and more blood rushes in, reducing the amount of oxygen-fee hemoglobin and producing a change in the magnetic field in the active area. Software allows viewing this

change, displaying colored areas overlapping the grey-scale image of the brain and refreshing the image every 2 to 5 seconds. fMRI allows measuring brain activity and searching for patterns while subjects perform certain tasks or experience marketing stimuli. Data analysis can be conducted using specific software packages, as *BrainVoyager QX* (Levy et al., 2011; Morris et al. 2009) or Statistical parametric Mapping (SPM5) (Falk et al. 2009; Plassmann et al. 2008; Stoll et al. 2008; Plassmann et al. 2007).

Positron emission tomography (PET) is another expensive method to use that can obtain physiologic images with spatial resolution similar to fMRI by recording the radiation from the emission of positrons from the radioactive substance administered to the subject. A battery of detectors surrounds the subject's head and traces radiation pulse, without precisely identify the location of the signal, as Zurawicki (2010) notes. Technical issues involve obtaining the radioactive material and it's short life.

Electroencephalography (EEG) is one of the most used tools in neuromarketing research, after fMRI. The amplitudes of the recorded brain waves correspond to certain mental states, such as wakefulness (beta waves), relaxation (alpha waves), calmness (theta waves) and sleep (delta waves). A number of electrodes (up to 256) are placed on the scalp of the subjects, in certain areas, in order to measure and record the electricity for that certain spot. As Zurawicki (2010) states , technology allows EEG to be a portable device and record brain activity in any many circumstances, as for example in supermarkets. Also, EEG is able to record only activity data from superficial layers of the cortex.

Magnetoencephalography (MEG) uses magnetic potentials to record brain activity at the scalp level, having sensitive detectors in the helmet placed on the subject's head. Magnetic field is not influenced by the type of tissue (blood, brain matter, bones), unlike electrical field used in EEG, and can indicate the depth of the location in the brain with high spatial and temporal resolution. Zurawicki (2010) states that experiments using MEG need a room free of earth's magnetic field.

Transcranial magnetic stimulation (TMS) uses magnetic induction in order to modulate the activity of certain brain areas that are located 1-2 centimeters inside, without reaching the neocortex. New TMS technology allows also targeting lower brain areas and is less expensive than PET or fMRI scanners. A plastic case containing an electric coil is positioned near to the subject's head. TMS discharges a magnetic field that passes through the brain, allowing making changes in the brain tissue in certain

locations and being able either to temporary activate neurons (using high frequency) or temporary disable neuronal activity (low frequency). Zurawicki (2010) compares TMS to fMRI, stating that TMS is able to highlight causal inferences by analyzing the subject in front of a marketing stimuli while certain brain areas are disabled, stimulated, or normal.

The following methods can be used together with the neuroimaging tools described above in order to obtain more information and internal validation in studies.

Eye Tracking allows studying behavior and cognition without measuring brain activity, but where the subject is looking at, for how long he is looking, the path of the subject's view and changes in pupil dilation while the subjects looks at stimuli. As Laubrock et al. (2007) state, eye tracking allows measuring the attention focus and thus monitoring types of behavior. Zurawicki (2010) states that eye movements fall into two categories: fixations and saccades. Fixation is when the eye movement pauses in a certain position and saccade is a switch to another position. The resulting series of fixations and saccades is called a scan path, and they are used in analyzing visual perception, cognitive intent, interest and salience. O'Connel et al. (2011) reports a study that confirms that eye tracking provides more accurate information than self-report, as research shows that claimed viewing is not always the same as measured actual viewing.

Measuring Physiological Responses to stimuli can provide information on the subject's emotional effects by monitoring the heart rate, blood pressure, skin conductivity (affected by sweat, measuring arousal level), stress hormone from saliva, facial muscles contractions, and inferring the emotional state for each moment.

Response time measures computes the amount of time between stimuli appearance and it's response, informing researchers on the complexity of the stimulus to an individual and how the subject relates to it, as Zurawicki (2010) states. This cheap method can be used on recall studies or on measuring subject's attitude towards certain stimuli.

Calvert et al. (2004), Kenning et al. (2005) and Zurawicki (2010) have divided the types of tools used in neuromarketing research into the ones that record metabolic activity and the ones that record electric activity in the brain. Fugate (2007) considers that advances in imaging technology will no doubt also provide cheaper, smaller and less obtrusive devices in the near future.

3. Qualitative versus Quantitative in Neuromarketing Research

Qualitative research is an in-depth exploration of what triggers people on a particular subject: their feelings, perceptions, decision-making processes, and so on (Sellers, 1998). The most common forms of qualitative research are focus groups and depth interviews. Qualitative research will provide a much deeper understanding of how the target market thinks, but it does not provide data that can be projected and derived, so results cannot be generalized.

On the other hand, *quantitative research* can be generalized, as it employs a larger sample (through mail, telephone or internet) which is representative of the entire population being researched (Ron Sellers, 1998), but it won't provide the depth of information available through qualitative research.

Each approach has its drawbacks, as quantitative research often forces responses or people into categories that might not fit them, and qualitative research, on the other hand, sometimes focuses too closely on individual results and fails to make connections to larger situations or possible causes of the results. But the solution would come in finding the most effective way to incorporate elements of both to ensure that their studies are accurate and valid.

Thomas (2010) considers that qualitative and quantitative research always need each other in science, but because typically qualitative data involves words and quantitative data involves numbers, there are some researchers who feel that one is better (or more scientific) than the other. As he remarks, that in recent years, data-collection methods have expanded from in-person focus group discussions, depth interviews and observation to include online chats, bulletin board forums, online communities and web monitoring. Also, some researchers would also include neuromarketing research (physiological measures of human reactions) as a part of the qualitative domain.

Neuromarketing research is based on experiments using the techniques mentioned above. As Venn Diagrams would best describe the logical relation between quantitative, qualitative and neuromarketing research, I will use Figure 1 to illustrate this relationship.

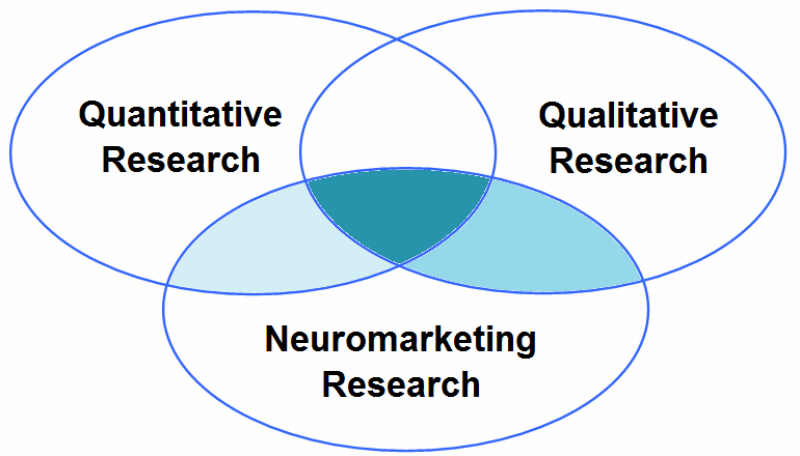

Figure 1. Venn Diagrams show the logical relation between Quantitative Research, Qualitative Research and Neuromarketing Research

In the following sections there will be analyzed the common space between quantitative research and neuromarketing research, respectively between qualitative research and neuromarketing research (following comments on qualitative and quantitative issues of Johnson et al. 2008; Lichtman 2006), and afterwards it will be decided if neuromarketing research is closer to a quantitative approach, or to a qualitative one.

3.1. Neuromarketing and Quantitative Research

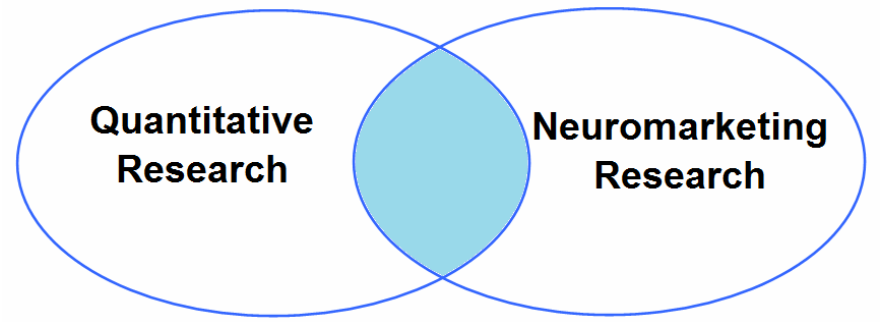

Figure 2. Neuromarketing Research intersects with Quantitative Research

With regards to neuromarketing research and quantitative research, there are some common points that are highlighted below:

- Psychophysiolgical techniques from neuromarketing research use a number of indicators to keep track of different psychological responses to stimuli, responses that

can be represented by cognitive and affective, as Wang (2008) states. Quantitative measures of the cognitive processes include measures of beliefs, knowledge, attitudes, attention, memory, recall and everything that happens in the subject's mind. On the other hand, the affective process is a mental state that develops spontaneously without cognitive effort, and is involved with a set of emotional reactions.

- Rapid technological evolution enables marketing researchers to use more advanced equipment to conduct psychophysiological measurements. Researchers usually have to visually examine brain wave patterns recorded by EEG and also conduct brain wave mapping and statistical analyses using specific algorithms and software. Using computer-aided EEG, future marketing research may aim to identify the relationships between psychological processes and certain patterns of brain waves.
- Most data analysis in neuromarketing research includes preprocessing, statistical analysis, data interpretation (behavioral analysis and neuroimaging data analysis) and triangulation. Reimann et al. (2011) presents preprocessing as having different phases which perform time correction (between appearance of stimuli and recording the signal of its effect), head motion correction, normalization (using algorithms in order to obtain a standard brain template) and smoothing (removing noises using Gaussian filters). Statistical analysis on the level of brain regions in order to find the Voxels (coordinates) for which the time series (fitting a general linear model) significantly correlates with a specific experimental condition. Data interpretation should confirm or infirm the hypothesis of the research, and triangulation should validate the research by correcting complementary sources and linking them to the data acquired with neuroimaging. Vechiatto et al. (2010) present some considerations concerning the use of adequate statistical techniques in neuroimaging data analysis, as this data can contain errors and needs to be checked before the analysis. They observed that more than a third of the studies published don't take into consideration this errors and use the data without the necessary adjustments.
- Neuromarketing studies requires a hypothesis in order to begin the research, being deductive and similar to quantitative research. Also, the study is confirmatory (top-down), as the researcher tests the hypothesis and theory with the data.
- Similar to quantitative research, the researcher that performs a neuromarketing study is an objective observer that neither participates in nor influences what is being studied.

- The purpose of neuromarketing studies is to test hypothesis, look at cause and effect and make predictions concerning consumer behavior, developing a quantitative approach.
- Using neuroimaging tools in marketing research implies objectivity and standard procedures (involving the study conducted, ethical implications taken into consideration and the analysis of the results).
- Although using a small sample size, findings can be generalized, as brain mechanisms of people are similar.

3.2. Neuromarketing and Qualitative Research

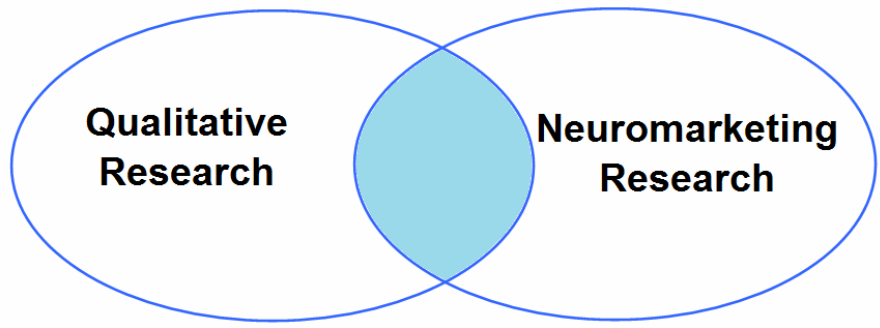

Figure 3. Neuromarketing Research intersects with Qualitative Research

- Neuromarketing research passes the boundaries of traditional marketing research methods through the information provided and with the great advantage that it requires only 10% of subjects that would be necessary for traditional methods. Also, neuromarketing studies are small sample sized (not randomly selected) due to costs and complexity of the experiments, but taking into consideration that the data collected also contains noises that must be removed, at least 15 to 20 participants should be recruited to such studies in order to obtain internal validity. The to the small amount of subjects used make neuromarketing research come closer to the qualitative side and stay further from the quantitative one.
- Neuroimaging technology, through it's technical specifications, is able to provide accurate data for analysis. By combining a good temporal resolution technique (such as EEG or MEG, as stated in Ariely et al. 2010; Kenning et al. 2007) with a good spatial resolution technique (like fMRI, as stated in Plassmann et al. 2011), the researcher will gather quality information.

- Invasive methods (such as PET or TMS) change the role of the researcher (who is usually an observer), as he is able to activate or temporary disable areas of the brain or to add radioactive chemicals in the subject's blood.
- When qualitative methods (survey) are most vulnerable to distortion (by dealing with sensitive topics or abstract ideas), methods that don't rely on explicit questions can reveal unstated attitudes more effectively (as consumer face challenges when trying to express their thoughts), and neuroimaging is the most appropriate tool to use. Also, in order to find out the steps of the process of decision-making, neuroimaging is able to decrypt human mind, highlighting emotional or cognitive aspects. Given the importance of emotion in motivating behavior, neuromarketing research has a powerful role in these studies.
- Neuromarketing research aims to gather deep understanding by exploring the studied phenomenon.

3.3. Common aspects in Neuromarketing, Quantitative and Qualitative Research

- Data provided by neuromarketing studies are both pictures and numbers, statistics.
- Most common research objectives are to describe, explain or predict (quantitative approach), but also to explore, discover, construct (qualitative approach).
- Mostly, subject's behavior is studies under controlled conditions, isolating causal effects, but new technology allow conducting the experiment in the natural environment (for example, in the supermarket).

4. Conclusions

Despite the fact that neuromarketing research implies measuring brain activity in numbers (quantitative data collection), literature seems to classify it as fitting more to the qualitative side of research. But after analyzing each component, we can conclude that neuromarketing research is closer to the quantitative approach. In order not to frame it in one category or the other, we can consider neuromarketing research as being a triangulation of research, as it implies defining a problem (qualitative approach), defining and test hypothesis (quantitative approach) and exploring the results in depth (qualitative approach).

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